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Pacific Harbor Seal (*Phoca vitulina richardsi)* Monitoring at Point Reyes National Seashore and Golden Gate National Recreation Area

2008 Annual Report

Natural Resource Technical Report NPS/SFAN/NRTR—2009/267

ON THE COVER
Pacific harbor seals (*Phoca vitulina richardsi*) hauled out on a sandbar edge in Drakes Estero, Point Reyes National Seashore.
Photograph by: Judy Bourke

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All manuscripts in the series receive the appropriate level of peer review to ensure that the information is scientifically credible, technically accurate, appropriately written for the intended audience, and designed and published in a professional manner. This report received formal peer review by subject-matter experts who were not directly involved in the collection, analysis, or reporting of the data, and whose background and expertise put them on par technically and scientifically with the authors of the information.

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Contents

Figures

Page

Tables

Page

Abstract

Pacific harbor seals (*Phoca vitulina richardsi*) are the dominant and only year-round resident pinniped in the San Francisco Bay Area, California. Long-term monitoring studies have been conducted at the largest harbor seal colonies in Point Reyes National Seashore since the mid 1970's. The objectives of monitoring each site and the population as a whole are to i) detect changes in population size, ii) detect changes in reproductive success by way of pup production, and iii) identify anthropogenic or environmental factors that may affect the condition of the population (Adams et al. In Prep).

Harbor seal surveys were conducted throughout the 2008 breeding (March through May) and molting (June through July) seasons once to twice per week at the largest Point Reyes and Golden Gate harbor seal colonies, collectively referred to as Marin County locations. Members of the Harbor Seal Monitoring Volunteer Program helped to complete 254 surveys at eight Marin County locations, contributing an estimated 453 hours. During the breeding season, 2,499 adults and immature seals and 1,171 seal pups were counted at all Marin County monitoring locations. Drakes Estero had the most adults (627), followed by Double Point (496). Drakes Estero and Double Point accounted for 57% (669) of pups at Marin haulouts. During the molting season, 3,953 animals were counted at Marin County locations. During surveys, 108 disturbances to seals were recorded. The most frequent causes were human (47.2%), unknown (16.7%), and motor boat (10.2%). Thirteen regional surveys were conducted throughout the season at locations in Sonoma, Marin, San Francisco, and San Mateo counties. Of the counties surveyed, Marin County locations accounted for 63.4% of breeding season adults/immatures, 82.7% of pups, and 68.3% of seals during the molting season.

Acknowledgements

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Finally, we are grateful for the generous contributions from the Point Reyes National Seashore Association, the David and Vicki Cox Family Foundation, the San Francisco Bay Area Inventory and Monitoring Program, and the Marin Conservation Corps/AmeriCorps Program.

The following peer reviewers greatly improved this document: M. Lowry, D. Greig, B. Becker, and J. Skancke.

Introduction

The mission of the National Park Service (NPS) is "to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations" (NPS 1916). To uphold this goal, the Director of the NPS approved the Natural Resource Challenge to encourage national parks to focus on the preservation of the nation's natural heritage through science, natural resource inventories, and expanded resource monitoring (NPS 1998). Through the Challenge, 270 parks in the national park system were organized into 32 inventory and monitoring networks.

The San Francisco Bay Area Network (SFAN) includes Golden Gate National Recreation Area, John Muir National Historic Site, Pinnacles National Monument, and Point Reyes National Seashore. The network has identified vital signs, indicators of ecosystem health, which represent a broad suite of ecological phenomena operating across multiple temporal and spatial scales. Our intent has been to monitor a balanced and integrated "package" of vital signs that meets the needs of current park management, but will also be able to accommodate unanticipated environmental conditions in the future. Pacific harbor seals represent a particular high priority vital sign for SFAN because they are ecologically significant, have protected status through the Marine Mammal Protection Act, and are of high interest to the public (Adams et al. 2006; Adams et al. In Prep).

The information presented in this report is a summary of the harbor seal data collected at Point Reyes National Seashore and Golden Gate National Recreation Area during the 2008 breeding and molting seasons, March-July. Summary data collected as part of a region-wide survey effort, including adjacent areas (San Francisco Bay, San Mateo County, and Sonoma County) where NPS surveys were conducted in conjunction with other agencies and organizations for 2008, are also presented. This report is not intended to analyze long-term trends in the harbor seal data set, which are more appropriately investigated at five year intervals (i.e. Allen et al. 2004). Furthermore, this document is not intended to report on or analyze data specific to NPS management issues related to harbor seals.

Background

Pacific harbor seals (*Phoca vitulina richardsi*) are the dominant and only year-round resident pinniped in the San Francisco Bay Area, California. The population at Point Reyes National Seashore represents the largest concentration of harbor seals in the State of California, and accounts for approximately 20% of the mainland molting population (Lowry et al. 2008). Much of the Point Reyes coastal zone remains relatively pristine and provides good marine and terrestrial habitat for seals to rest, molt, feed, and breed where human encroachment is minimal (Figure 1). The inaccessibility of much of the area has historically afforded some protection from human disruption during the seals' terrestrial resting periods; however, some pinniped populations in California are still recovering from a long period of exploitation that did not end until the passage of the Marine Mammal Protection Act in 1972 (Sydeman and Allen 1999). Human disturbance of seals at colonies is of interest to the National Park Service (NPS) because over 2.2 million visitors visit Point Reyes annually (NPS 2008) and several million more visit the Golden Gate National Recreation Area, many of whom visit tidepools, beaches and estuaries

within the parks. The parks may implement management actions to reduce disturbance to seals at colonies, if appropriate.

Objectives

Long-term monitoring studies of harbor seals have been conducted at the largest colonies in Point Reyes National Seashore since the mid 1970's (Allen and Huber 1984; Allen et al. 1989; Sydeman and Allen 1999; Allen et al. 2004). The objectives of monitoring each site and the population as a whole are to i) detect changes in population size, ii) detect changes in reproductive success by way of pup production, and iii) identify anthropogenic or environmental factors that may affect the condition of the population. The monitoring objectives and protocol are described in detail in the *San Francisco Bay Area Network Pinniped Monitoring Protocol*, scheduled for completion in 2009 (Adams et al. In Prep).

Figure 1. Harbor seals resting onshore during the pupping season at Seal Island within Tomales Bay. Photograph by Sue Van Der Wal.

Methods

Study Area

The study area extends from Tomales Point to San Francisco Bay (Figure 2). The Point Reyes peninsula extends from the mouth of Tomales Bay (Lat. 38° 30'N) south to Bolinas Lagoon (Lat. 37° 30'N). Point Bonita is located in the Marin Headlands, at the mouth of San Francisco Bay in the Golden Gate National Recreation Area. For this paper, the Point Reyes sites and Point Bonita are collectively referred to as Marin County locations. Point Reyes National Seashore, Golden Gate National Recreation Area, Gulf of the Farallones National Marine Sanctuary, the California State Parks, and the county parks share jurisdiction over segments of this coastline.

The topographic diversity of this coastal zone provides a broad range of substrates for harbor seals to come ashore. These include tidal mud flats, offshore and onshore rocky tidal ledges, and sandy beaches. A "haulout site" is defined as a terrestrial location where seals aggregate for periods of rest, birthing, and nursing of young (Harvey 1987; Thompson 1987). Each site, or location, is comprised of several "subsites", or distinct areas of beach, rock outcrops, or sandbars where harbor seals haul out. Coastal embayment sites include Tomales Bay, Drakes Estero, Bolinas Lagoon, and San Francisco Bay. Coastal sites surveyed include Tomales Point, Point Reyes Headlands, Duxbury Reef, Double Point, and Point Bonita (Figure 2).

The sampling design for this program was developed so that the data could be integrated with other regional surveys, allowing for the results to be interpreted in a regional context. Annually, the National Park Service participates in regional harbor seal surveys during the breeding and molting seasons, with the Point Reyes National Seashore coordinating the central coast surveys. Regional survey sites include colonies in San Francisco Bay (Alcatraz, Mowry Slough, Castro Rocks, Yerba Buena Island, and Newark Slough), Sonoma County (Sea Ranch, South Sonoma sites, and Jenner) and San Mateo County (Fitzgerald Marine Reserve, Pescadero, Pebble Beach, Point San Pedro, Bean Hollow, and Cowell Ranch Beach) (Figure 2).

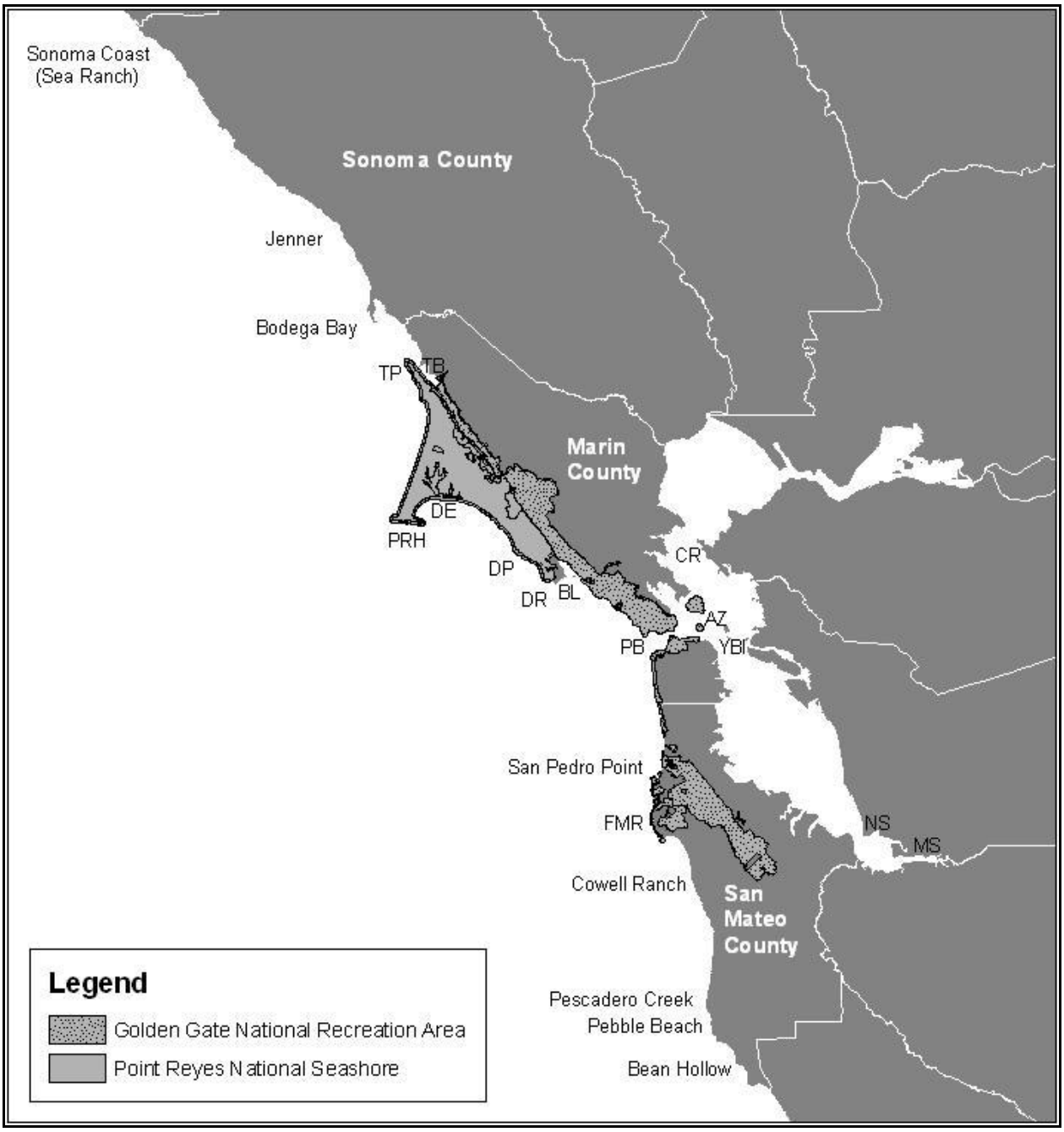

Figure 2. Regional survey sites in San Francisco Bay and Sonoma, Marin, and San Mateo counties, California. Map does not present all of the regional survey locations included in Sonoma and San Mateo counties. TB=Tomales Bay, TP=Tomales Point, DE=Drakes Estero, PRH=Point Reyes Headland, DP=Double Point, DR=Duxbury Reef, BL=Bolinas lagoon, PB=Point Bonita, CR=Castro Rocks, AZ=Alcatraz Island, YBI=Yerba Buena Island, NS=Newark Slough, MS=Mowry Slough, FMR=Fitzgerald Marine Reserve.

Surveys

Volunteer observers were trained to monitor harbor seals at designated sites within Point Reyes and at Point Bonita during two classroom and three field sessions in February and March 2008 (Figure 3). The majority of the volunteers had been previously trained and returned to the 2008 season with many years of experience. New volunteers were required to be mentored by returning volunteers at a site before they conducted an unsupervised survey.

Figure 3. Volunteer training at Tomales Bay. NPS Photo.

Harbor seal surveys were conducted throughout the breeding (March 1st through May 31st) and molting (June 1st through July 31st) seasons once to twice per week at each Marin County location. Surveys were conducted at medium to low tides (below 3ft) during the day. Surveys were not conducted in heavy fog because of poor visibility and they were not conducted in the rain because harbor seals haul out in lower numbers in the rain (Jemison and Pendleton 2001).

Generally, volunteers surveyed for 2 hours from fixed observation points with all subsites counted approximately every 30 minutes for a total of four counts each survey. Subsites were counted and recorded separately on pre-formatted datasheets and then added for site totals every half hour. Tomales Point, Bolinas Lagoon, and Duxbury Reef often had only two counts each survey due to hiking/traveling time between subsites.

For each subsite the observer recorded the time, number of adult and immature seals, pups, dead pups, red-pelaged seals, and fresh shark-bitten seals. Red pelage is easily identified and results from the deposition of iron oxide precipitates on the hair shaft; it usually extends from the head down to the shoulder and is of interest due to its rarity outside of the San Francisco Bay Area (Allen et al. 1993). During the molting season (June-August) all animals were counted as adults or immature seals because of the difficulty in distinguishing large pups from immature seals.

On a separate data form, disturbances and potential disturbances were recorded as they occurred. Disturbances included any events that caused the seals to lift their head (head alert), flush, or flush into water, while potential disturbances were defined as any anthropogenic event within a defined haulout zone that had the potential to flush seals. Observers recorded the time, source, and effect of each disturbance. The information on the effect included the reaction of the seals, the numbers of seals that reacted, and when and where they re-hauled if they were flushed into the water. In some cases the disturbance was not directly observed, but surveyors recorded the number of animals affected with an unknown disturbance. Disturbances were recorded by fixed categories to assist with summary analyses (Table 1).

Table 1. Categories used to record disturbance sources on field datasheets.

Source	Example
Motor-boat	Motorboat, Jet ski
Non Motor-boat	Canoe, Kayak, Sailboat, Wind surfer
Vehicle	Car, Bus, Motorcycle
Dog	Dog, Dog barking
Aircraft	Airplane, Helicopter, Hang glider, Ultralight
Human	Clammer, Researcher, Oyster Worker, Hiker, Horse rider
Bird	Turkey Vulture, Gull, Raven
Other	Coyote, Other Pinniped, Rock Slide, etc.

On alternating weekends, regional surveys were conducted at all sites included in regional counts (see Figure 2). Participants in region-wide surveys included various organizations and volunteers. Regional counts could be conducted at anytime between Thursday and Monday over the selected regional survey weekends.

All count and disturbance datasheets were entered into a relational Microsoft Access database during the course of the field season. At the end of the season, the database records were error-checked against the paper datasheets for accuracy. The records were further reviewed to ensure that only accurate and complete count data were used for analysis. For example, incomplete counts or counts that may have been hampered by poor weather conditions were noted in the database as poor quality surveys.

Data Management and Analysis

Although harbor seal data were collected according to subsites at each monitoring location, subsite data are not reported or analyzed within this report. By summing the subsite counts for each survey time interval, the maximum site total was identified for each survey and used for data summaries and analyses. The maximum total site count for each survey includes the adult/immature and pup age categories during the breeding months of March, April, and May.

The maximum number of seals counted at a site over the course of the entire season is often used for comparisons between years and sites. Because there is little to no movement of harbor seals between sites during the pupping and molting seasons, it was assumed that individual animals were not counted at more than one site (Harvey and Goley 2005). The maximum total count for each year within the study area was determined by taking the sum of the maximum count at each location. The maximum total count was determined separately for the breeding and molting

seasons. Maximum counts at each location may have occurred on separate days (see Barlow 2002). When compiling count summaries from the harbor seal data, only records noted as high quality counts were included. During the regional survey weekends, it was not uncommon for a site to be surveyed more than once. In these cases, the survey with the greater seal count was used for any regional summaries.

The total maximum counts of breeding season adults/immatures, pups, and molting season harbor seals were averaged separately across survey years 2000 to 2008 and compared to the 2008 data. Inclusion of all survey years in the average calculation accounts for the inherent inter-annual variability in the harbor seal population and reproductive output.

When examining disturbance events, only actual disturbances, those that elicited a head-alert or flush reaction from the seals, were used for analysis. Disturbance tallies were based on disturbance sources rather than the number of subsites or seals affected. Disturbance rates were calculated as the number of disturbance events that occurred during the time period from the first observation to the end of the final observation period. Because the disturbance data were not analyzed for effects on the seal count data in this report, all actual disturbance data were used for analysis regardless of the quality of the associated seal count data. Potential disturbances (events that could potentially elicit a reaction from seals) were recorded by volunteers to quantify any given type of disturbance recurring at a particular site, but this information is not analyzed in this report. These data may be used to understand potential emerging disturbance issues at each location.

The harbor seal monitoring data is dynamic and may change over time as errors are discovered and fixed or data analysis procedures are corrected or improved. For this reason, summary data reported here for 2000 to 2007 may differ from data summaries published in previous harbor seal reports. In particular, a thorough review and update to the disturbance data occurred since the 2007 annual harbor seal monitoring report (Truchinski et al. 2008).

Results

Overall

In 2008, 38 volunteers helped to complete 254 surveys at Marin County locations between March 1st and July 31st, completing an estimated 453 hours. Each location was surveyed between 7 and 41 times, which includes 13 regional surveys. During the breeding season (March-May), a maximum of 2,499 adults and 1,171 pups were observed in Marin locations, with the numbers growing to 3,953 individuals during the molting season (June-July) (Table 2).

Table 2. Summary data of harbor seal colonies for the 2008 season. All reported numbers reflect the maximum number seen during a single census.

Location	Max # adults in breeding season[1]	Max # pups in breeding season	Max # seals in molting season[2]	# Surveys		Max # reds[3]	Max # shark bites[3]	Max # dead pups[3]
Bolinas Lagoon	272	153	405	Weekday: Weekend:	27 9	12	2	2
Double Point	496	328	904	Weekday: Weekend:	18 21	7	4	6
Drakes Estero	627	341	1342	Weekday: Weekend:	24 17	11	5	5
Duxbury Reef	32	3	96	Weekday: Weekend:	32 10	0	0	0
Point Reyes Headlands	142	64	97	Weekday: Weekend:	6 1	0	0	0
Tomales Bay	382	118	380	Weekday: Weekend:	21 12	15	1	1
Tomales Point	384	154	577	Weekday: Weekend:	17 12	6	2	1
Point Bonita	164	10	152	Weekday: Weekend:	21 6	7	2	0
TOTAL	**2,499**	**1,171**	**3,953**		**254**	**58**	**16**	**15**

1. Max # breed = adults and immatures during the breeding season, March 1 to May 31.
2. Max # molt = all age classes during the molting season, June 1 to July 31.
3. Max # red, shark bites, and dead pups are the maximum number observed March 1 to July 31.

Adult and Pup Counts During the Breeding Season

Adults: The maximum number of adult and immature seals hauling out during the 2008 breeding season was 2,499 (Figure 4). Drakes Estero had the most adults (627), followed by Double Point (496, Table 2).

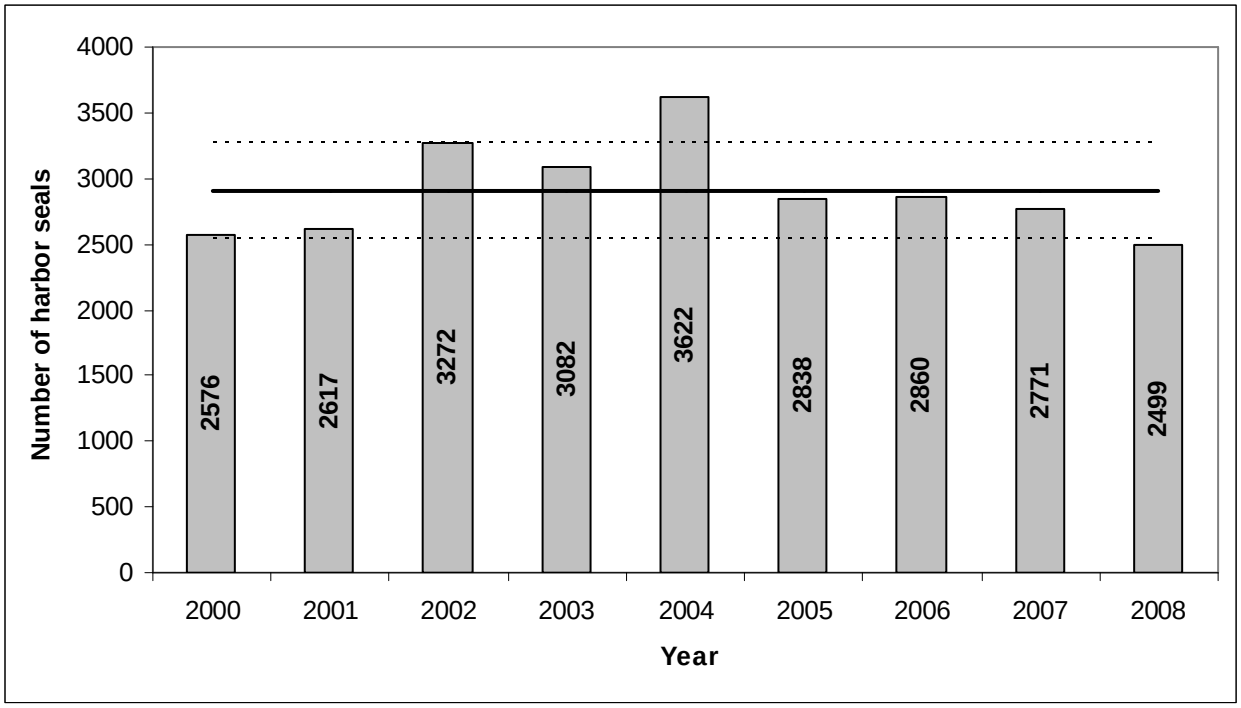

Figure 4. Maximum counts of harbor seal adults and immatures during the breeding season (March-May) for 2000-08 at Marin County locations. The solid line on the graph represents the mean of the maximum adult counts from 2000–2008 (mean=2904.1) and the dashed lines represent one standard deviation from the mean (SD=364.1).

Pups: The combined maximum pup count for all Marin County locations during the 2008 breeding season was 1,171 pups (Figure 5). Drakes Estero and Double Point accounted for 57% (669) of pups at Marin haulouts, which was consistent with the proportions of pups in the past.

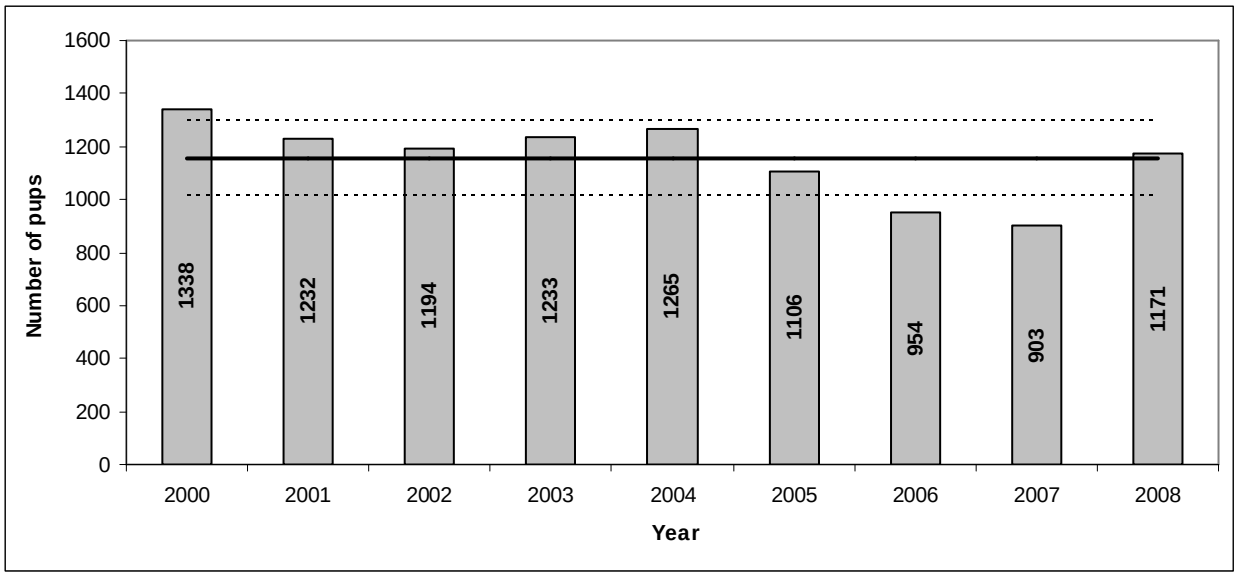

Figure 5. Maximum harbor seal pup counts for 2000–2008 at Marin County locations. The solid line on the graph represents the mean of the maximum pup counts from 2000-08 (mean = 1,155.1) and the dashed lines represent one standard deviation from the mean (SD = 143.9).

The date of the first pup observed has been documented since 2000, and there was no apparent trend in the date or location of the first pup observed from 2000 to 2008 (Table 3). In 2008, there were several reports of carcasses suspected to be dead pups during the first two weeks of March, but the first live pups were confirmed at Bolinas Lagoon on March 16. This is within the normal birth date range for this area.

Table 3. Date of first pup observed in the season by location, 2000–2008.

Year	Date	Location
2000	March 14	Point Reyes Headlands
2001	March 16	Tomales Bay
2002	March 3	Drakes Estero
2003	March 27	Bolinas Lagoon
2004	March 20	Double Point
2005	March 6	Drakes Estero
2006	March 9	Double Point
2007	March 2	Double Point
2008	March 16	Bolinas Lagoon

Of the dominant pupping sites (Bolinas Lagoon, Double Point, Drakes Estero, Tomales Bay, and Tomales Point), only Tomales Point did not have an increase in maximum pup numbers from 2007 to 2008 (Figure 6). Tomales Bay experienced the biggest difference (+64%) in pup numbers from 2007 to 2008, followed by Double Point (+53%) and Drakes Estero (+25%).

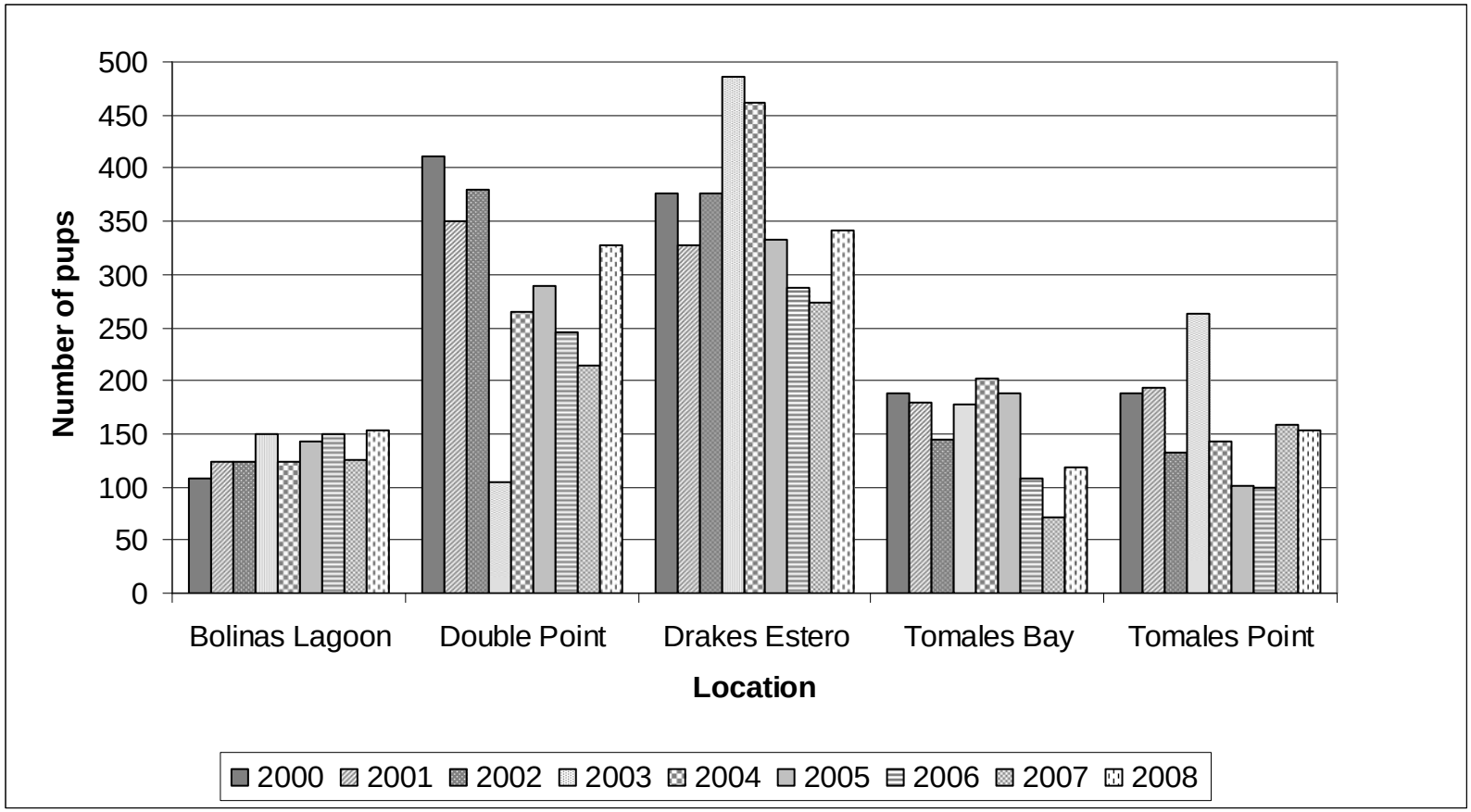

Figure 6. Maximum harbor seal pup counts at the dominant Marin County pupping locations, 2000–2008. The maximums of each site may have been observed on different days.

Molt Counts

The maximum count of all seals during the 2008 molt season for all Marin County locations was 3,953 seals (Figure 7). Similar to the pupping season, Drakes Estero and Double Point comprised 57% (2246) of the total seals counted during the molt season (Table 2).

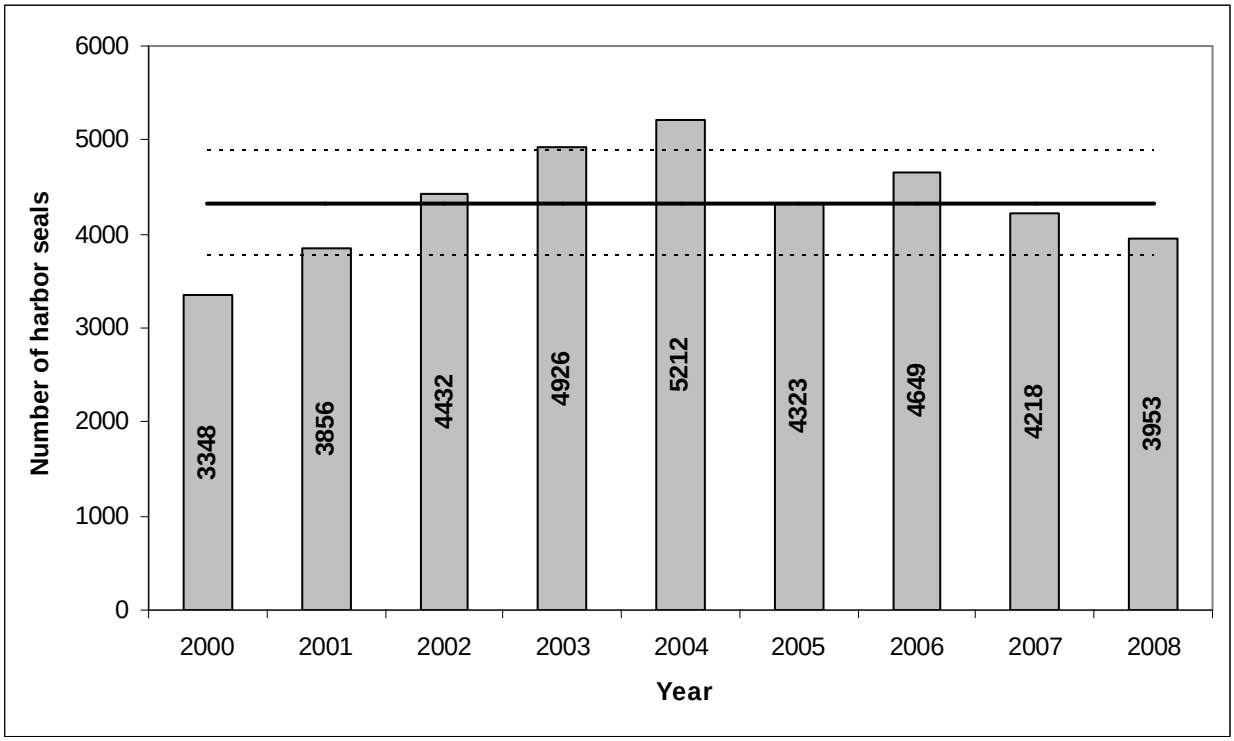

Figure 7. Maximum harbor seal counts during the molt season (June–July) for 2000–2008 at Marin County locations. The solid line on the graph represents the mean of the maximum molt counts from 2000-08 (mean = 4,324.1) and the dashed lines represent one standard deviation from the mean (SD = 568.8).

Disturbances

At the Marin County locations in 2008, 108 disturbances were recorded that elicited a response from harbor seals, which is the second lowest number of disturbances in the study period of 2000-2008 (Table 4). The most common disturbance source was humans (47.2%), which could have been a clammer, researcher, angler, or hiker (Table 4). Unknown sources and motorboats were the next most common sources with 16.7% and 10.2%, respectively. Drakes Estero had the most disturbances (32), but Bolinas Lagoon and Tomales Bay were close with 26 and 21 disturbances, respectively. Disturbances at Drakes Estero, including Limantour Estero, primarily resulted from hikers and clammers. Bolinas Lagoon has a subsite (Hwy 1) that is adjacent to a major roadway. This site is subject to loud, sudden noises from vehicles, as well as visitors that approach the seals. The disturbances at Tomales Bay were mostly related to passing boat traffic

Table 4. Identified sources of disturbances (head alert, flush, flush into water) for Marin County locations, from March 1st to July 31st, 2000–2008.

	Motorboat		Non-Motor Boats		Vehicle		Dog		Aircraft		Human		Bird		Unknown		Other		Total
	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	
2000	14	11.3	9	7.3	0	0.0	0	0.0	14	11.3	23	18.5	19	15.3	43	34.7	2	1.6	**124**
2001	14	10.8	12	9.2	2	1.5	1	0.0	4	3.1	45	34.6	9	6.9	28	21.5	15	11.5	**130**
2002	19	12.1	15	9.6	9	5.7	0	0.0	9	5.7	48	30.6	11	7.0	39	24.8	7	4.5	**157**
2003	13	9.8	20	15.0	3	2.3	0	0.0	10	7.5	38	28.6	10	7.5	32	24.1	7	5.3	**133**
2004	2	2.2	9	9.7	7	7.5	1	1.1	2	2.2	35	37.6	7	7.5	23	24.7	7	7.5	**93**
2005	9	7.3	14	11.4	1	0.8	2	1.6	10	8.1	43	35.0	10	8.1	31	25.2	3	2.4	**123**
2006	14	8.9	16	10.2	5	3.2	1	0.6	8	5.1	57	36.3	13	8.3	35	22.3	8	5.1	**157**
2007	29	13.8	21	10.0	14	6.7	2	1.0	14	6.7	70	33.3	13	6.2	45	21.4	2	1.0	**210**
2008	11	10.2	10	9.3	5	4.6	0	0.0	4	3.7	51	47.2	5	4.6	18	16.7	4	3.7	**108**
Average	**13.9**	**9.6**	**14.0**	**10.2**	**5.1**	**3.6**	**0.8**	**0.5**	**8.3**	**5.9**	**45.6**	**33.5**	**10.8**	**7.9**	**32.7**	**23.9**	**6.1**	**4.7**	**137**

and recreational clammers. Hundreds of people dig for clams on the mudflats in Tomales Bay during low tide weekends. The Farallones Marine Sanctuary Association (FMSA) formerly coordinated a program that situated docents on the mudflats during these high visitation days to educate visitors and protect the seals, but this program was terminated in 2005. Tomales Point, Duxbury Reef, and Point Reyes Headlands received few to no disturbances (4, 1, 0, respectively) likely because of the remoteness and inaccessibility of these sites.

In 2008, Drakes Estero had the greatest disturbance rate (0.41 disturbances/hr), followed by Tomales Bay (0.39) and Bolinas Lagoon (0.38, Figure 8). Of the sites that regularly have more than five disturbances per season, Double Point experienced the greatest change compared with 2007 with a 52% decrease in the disturbance rate (Figure 9). Bolinas Lagoon and Tomales Bay saw a 48% and 42% decrease in disturbance rates, respectively. Duxbury Reef and Tomales Point were the only sites to see an increase in disturbance rates with changes from 0.0 to 0.04 and 0.03 to 0.04, respectively. The rates of disturbances vary greatly from year to year depending on activities at each location.

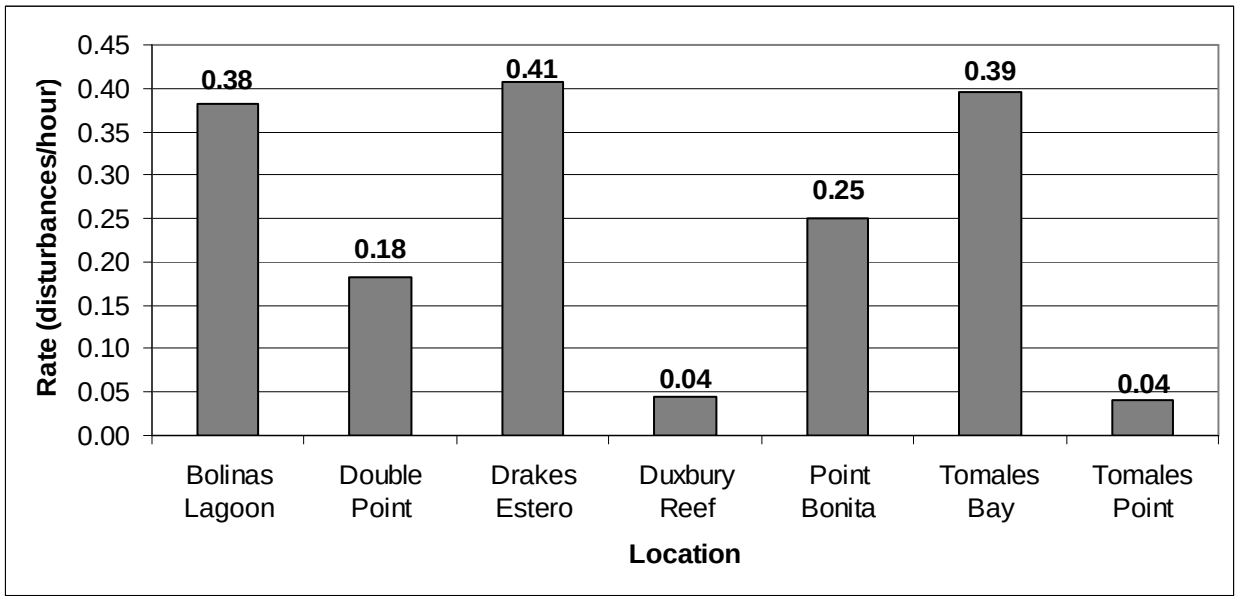

Figure 8. Rates of disturbances per hour at Marin County locations from March through July 2008. Only actual disturbances (head alert, flush, flush water) were used and survey time was based on observation time for all complete surveys (with or without disturbances).

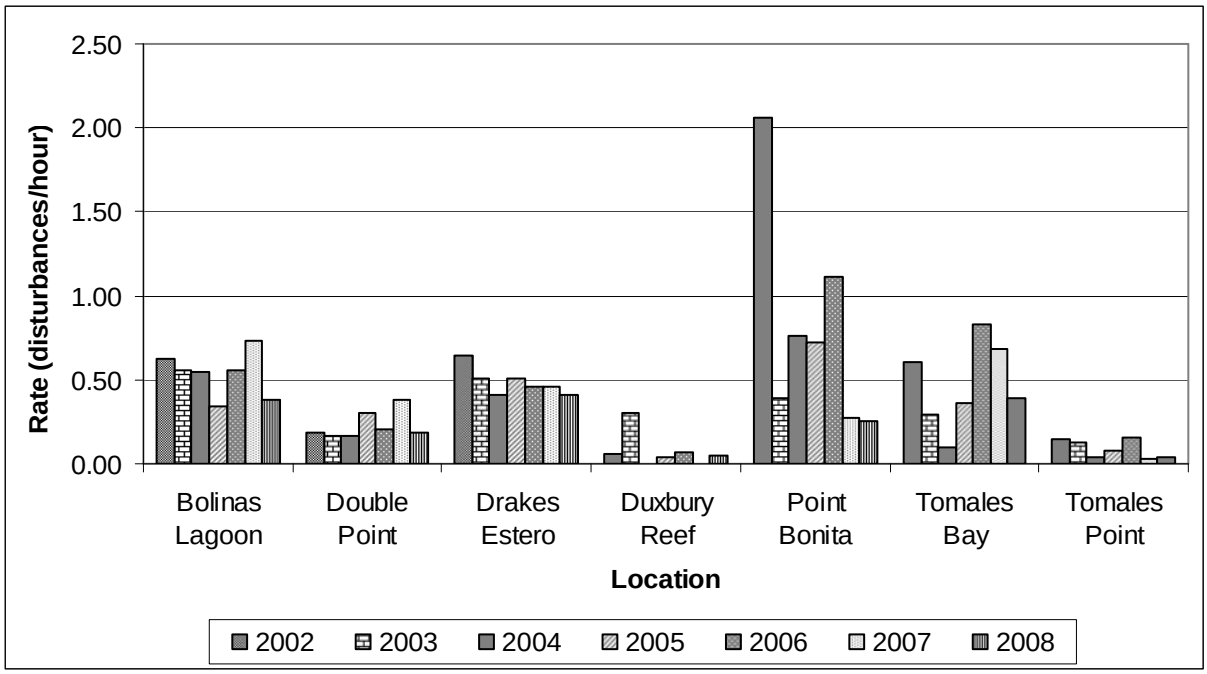

Figure 9. Rates of disturbances per hour at Marin County locations from March through July of 2002–2008. Only actual disturbances (head alert, flush, flush water) were used, and survey time was based on observation time for all complete surveys (with or without disturbances).

Summary by Site

Bolinas Lagoon

Bolinas Lagoon had 36 complete surveys between March 1st and July 31st, 2008. Of those surveys, 27 were on weekdays and 9 were on weekends. The maximum count during the breeding season had 272 adults and 153 pups. During the molting season, the maximum count was 405 seals (Table 2). Bolinas had one of the higher numbers of disturbances in 2008 and the dominant sources were humans and vehicles. This site is along scenic Highway 1 and many visitors stop to see the seals and approach them. Traffic noise also disturbs the seals, as well as kayaks in the lagoon. A coyote was witnessed as it flushed a seal on a sandbar in the lagoon, but it did not occur during an official survey (Figure 10). Bolinas Lagoon had a substantial decrease in disturbance rate from 2007 (0.74 to 0.38 disturbances/hr).

Double Point

Double Point had 39 complete surveys between March 1st and July 31st, 2008. Of those, 18 were on weekdays and 21 were on weekends. The maximum count during the breeding season was 496 adults and 328 pups. Molting season yielded a maximum count of 904 seals (Table 2). Double Point's disturbances were moderate and came mostly from unknown sources, birds, and humans. On two separate occasions during the weekend of April 12th, people were observed walking through the colony. In both instances, almost all seals flushed as the hikers approached pups. The unknown disturbances may be caused by small rockslides from the eroding cliffs above the beaches that observers can't see or hear. Double Point had the largest decrease in the disturbance rate from last year (0.38 to 0.18 disturbances/hr, 52% decrease) due to decreases in both aircraft and unknown sources.

Figure 10. A coyote approaching a seal in Bolinas Lagoon. Photograph by mojoscoast.

Drakes Estero

The Drakes Estero complex which includes Limantour Estero had 41 complete surveys between March 1st and July 31st, 2008. Of those, 24 were on weekdays and 17 were on weekends. The maximum count during the breeding season was 627 adults and 341 pups, and the maximum molt count was 1,342 (Table 2). Drakes Estero had the highest disturbance count, with 32 disturbances, as well as, the highest disturbance rate (Figure 8). Most of the disturbances (22) were from human sources and this included hikers and recreational clammers. Clamming is popular on Drakes Beach, where seals do not always haul out in large numbers, but the activities at times affect seals on nearby sandbars. Kayaking was the next greatest source of disturbance. The Estero is seasonally closed to kayaking from March to June during the critical pupping period. The disturbance rates for 2007 and 2008 were very similar, with 0.41 disturbances per hour in 2008 and 0.46 in 2007 (Figure 9).

Duxbury Reef

Duxbury Reef had 42 complete surveys between March 1st and July 31st, 2008. Of those, 32 were on weekdays and 10 were on weekends. During the breeding season, the maximum adult count was 32 and the maximum pup count was 3, while during the molting season the maximum seal count was 96 (Table 2). Duxbury had the lowest number of seals and only one documented disturbance, which had an unknown source. Disturbances are rarely recorded at Duxbury Reef, possibly due to the low accessibility of the location.

Point Bonita

Point Bonita had 27 complete surveys between March 1st and July 31st, 2008. Of those, 21 were on weekdays and 6 were on weekends. During the breeding season, the maximum count was 164 adults and 10 pups, while during the molting season the maximum seal count was 152. A yearling elephant seal was observed several times at this site, sometimes hauling out with the harbor seals. The disturbances at Point Bonita were primarily from human sources, which included anglers and hikers that enter the closed off area of this site. There have been fewer disturbances caused by humans since the area below the paved walkway was closed to visitors in mid-June 2007. The disturbance rates for 2007 and 2008 did not vary greatly, with 0.25 disturbances per hour in 2008 and 0.28 in 2007 (Figure 9).

Point Reyes Headlands

Point Reyes Headlands had 7 complete surveys between March 1st and July 31st, 2008. All of the surveys were completed during weekdays. During the breeding season, the maximum adult count was 142 and the maximum pup count was 64, while during the molting season the maximum seal count was 97 (Table 2). This site rarely has disturbances because of its remoteness and inaccessibility. Most of the harbor seals were seen at a large elephant seal colony pocket beach. There were some vacated spaces on the beach during the elephant seal molt, but harbor seals were also seen in extremely close proximity to the elephant seals. Several survey attempts were aborted due to heavy fog that is usually present in the Point Reyes Headlands during June and July.

Tomales Bay

Tomales Bay had 33 complete surveys between March 1st and July 31st, 2008. Of those, 21 were weekday and 12 were weekend surveys. During the breeding season, the maximum adult count was 382 and the maximum pup count was 118, while during the molting season the maximum seal count was 380 (Table 2). There were 21 recorded disturbances, all but one of which were caused by motor-boats and humans. The sand bars in Tomales Bay are a very popular spot for recreational clammers, and there were often 200 people on the sand bars during weekend surveys. The majority of disturbances (81%) occurred during the heavy weekend use. Tomales Bay had one of the highest disturbance rates of all locations in 2008, with 0.39 disturbances per hour, but this is 42% lower than last year's rate of 0.68.

Tomales Point

Tomales Point had 29 complete surveys between March 1st and July 31st, 2008. Of those, 17 were on weekdays and 12 were on weekends. During the breeding season, the maximum adult count was 384 and the maximum pup count was 154, while during the molting season the maximum seal count was 577. Only four disturbances occurred at this location, including one human disturbance and three of unknown causes. On one occasion, hikers were observed flushing seals from the beach adjacent to a rocky haul-out at Rope Beach. Due to its remoteness, however, the Tomales Point location is generally not frequented by park visitors. Abalone divers were observed there during the breeding season, but they were never seen disturbing seals.

Regional Sites

Thirteen regional surveys occurred between March 1st and July 26th, 2008 at 21 different locations. Not all sites were surveyed on all scheduled days. Some sites were surveyed on days other than regional survey days, and therefore could not be used in this summary. Other sites had difficulty with weather on certain days. During the breeding season, a maximum of 3,840 adults and 1,353 pups were observed, although the maximum counts may have occurred on different days for each location (Table 5). During the molting season, the combined maximum of all seals from each site was 4,951. Marin County locations accounted for 63.4% of the maximum adult/immature breeding count, 79.2% of the maximum pup count, and 68.3% of the maximum molt count.

Within the San Francisco Bay, high counts for seals occurred at Castro Rocks and Yerba Buena Island, with the most pups at Mowry Slough. In San Mateo County the highest concentration of seals was on the coast at Fitzgerald Marine Reserve, followed by Cowell Ranch. In Sonoma

County, the Sonoma Coast location accounted for the most seals this year, which is consistent with previous data. No counts were conducted this year at Fort Ross (in Sonoma County).

Disturbances in San Francisco Bay were only recorded at Castro Rocks and the sources included traffic on the bridge and the researchers. At Fitzgerald Marine Reserve and Sonoma Coast, tide poolers disturbed hauled out seals. At Jenner, kayakers caused disturbances.

Table 5. Regional surveys of harbor seal numbers in central California, March 1st through July 31st, 2008. Thirteen surveys were scheduled on alternating weekends, eight during the breeding season and five during the molt. Values reported as average (Avg), standard error (SE), and maximum (Max).

	Breeding Season					Molting Season			
Location	**N**	**Avg adults**	**SE**	**Max adults[1]**	**Max pups[2]**	**N**	**Avg**	**SE**	**Max seals**
Sonoma County[3]									
Sonoma Coast	6	145.2	17.2	196	100	5	220.0	37.4	304
Jenner	5	95.4	13.3	131	17	2	96.0	46.0	142
Marin County									
Tomales Bay	8	335.1	24.0	382	118	4	185.3	42.8	308
Tomales Point	7	249.1	31.3	384	154	5	320.4	35.3	436
Point Reyes Headland[4]	4	43.3	33.1	142	64	1	104.0	NA	104
Drakes Estero	8	475.1	41.1	627	341	5	936.0	151.0	1319
Double Point	8	277.1	36.9	489	332	4	487.8	56.3	636
Duxbury Reef	8	20.1	2.2	31	3	4	19.8	10.1	48
Bolinas Lagoon	8	166.4	20.2	241	107	5	339.2	32.8	405
Point Bonita	7	76.6	15.8	146	9	4	93.0	14.0	128
San Francisco Bay									
Alcatraz	6	4.8	2.2	12	0	3	0.7	0.3	1
Castro Rocks	8	158.5	21.8	262	43	5	121.2	17.6	145
YBI	7	118.0	11.8	161	7	5	165.4	13.7	199
Newark Slough[4]	8	16.6	4.9	43	8	5	8.8	3.6	20
Mowry Slough[4]	8	60.6	10.0	101	30	5	58.6	11.6	85
San Mateo County									
Point San Pedro	7	10.4	3.4	25	1	2	33.5	27.5	61
Cowell Ranch	7	83.4	17.6	150	27	5	102.6	17.1	152
Pescadero	7	26.1	2.5	34	6	5	26.4	5.4	40
Pebble Beach	7	55.7	8.6	79	20	5	92.6	8.3	116
Bean Hollow	7	9.4	3.4	23	4	5	3.2	1.8	8
Fitzgerald Marine Reserve	8	113.6	17.4	191	33	5	220.0	20.9	294
ALL SITES				**3,850**	**1,424**				**4,951**

[1]Based on the total for a single day.

[2] Based on the total for the same single day as above

[3]Fort Ross in Sonoma County has not been surveyed since 2006 and has been removed from this table

[4]Includes surveys that occurred outside of regional weekend period

Conclusion

Highlights

- 38 volunteers helped to complete 254 surveys at Marin County locations between March 1st and July 31st 2008, contributing approximately 453 survey hours.

- A maximum of 2,499 adults/immatures seals were counted ashore during the breeding season.
    - The greatest number of adults hauled out at Drakes Estero (627), followed by Double Point (496).

- A maximum of 1,171 pups were observed in Marin haulouts.
    - Drakes Estero and Double Point accounted for 57% (669) of pups at Marin haulouts.

- A maximum of 3,953 animals were counted during the molting season at Marin County sites.
    - Drakes Estero and Double Point comprised 57% (2246) of the total seals counted during the molt season.

- 108 disturbances were recorded during surveys.
    - The most common categories of disturbances were human (47.2%), unknown (16.7%), and motor boat (10.2%).

- Regional surveys occurred 13 times throughout the season, which include Sonoma, Marin, San Francisco, and San Mateo counties. Thirteen volunteers participated in these surveys.
    - Marin County locations accounted for 63.4% of breeding season adults/immatures, 79.2% of pups, and 68.3% of seals during the molting season.

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